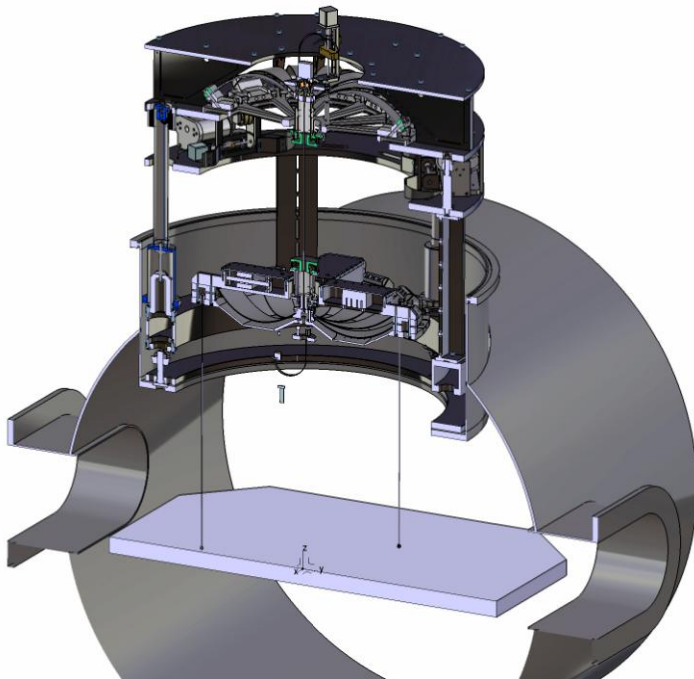


SBE STATUS REPORT

Jo van den Brand, Alessandro Bertolini, Martin Doets, Eric Hennes

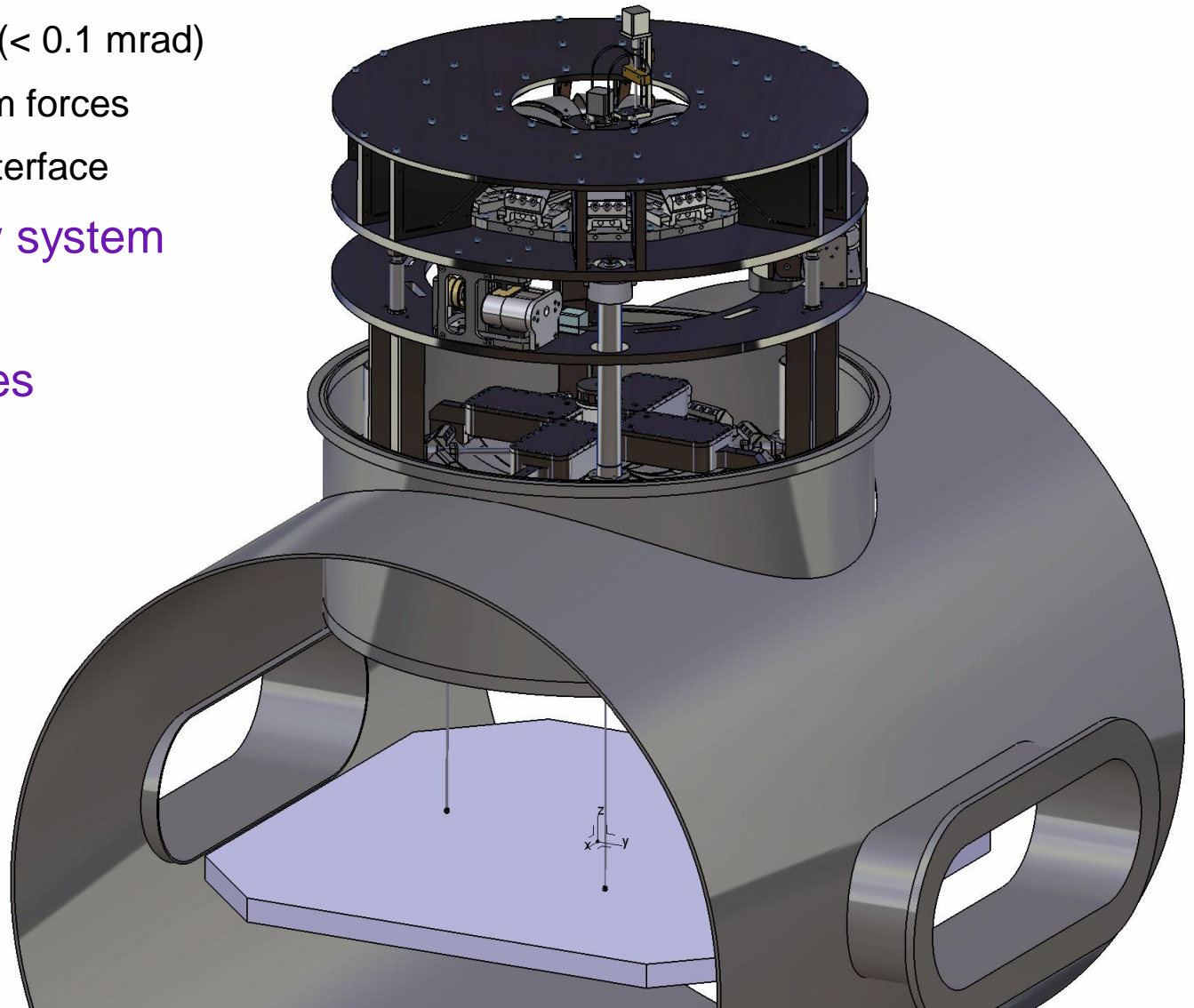


INTRODUCTION

- Introduction
 - General considerations
 - Design issues
- Status of project
 - SAS mechanics
 - Sensors
- Schedule
 - Prototype
 - Time line

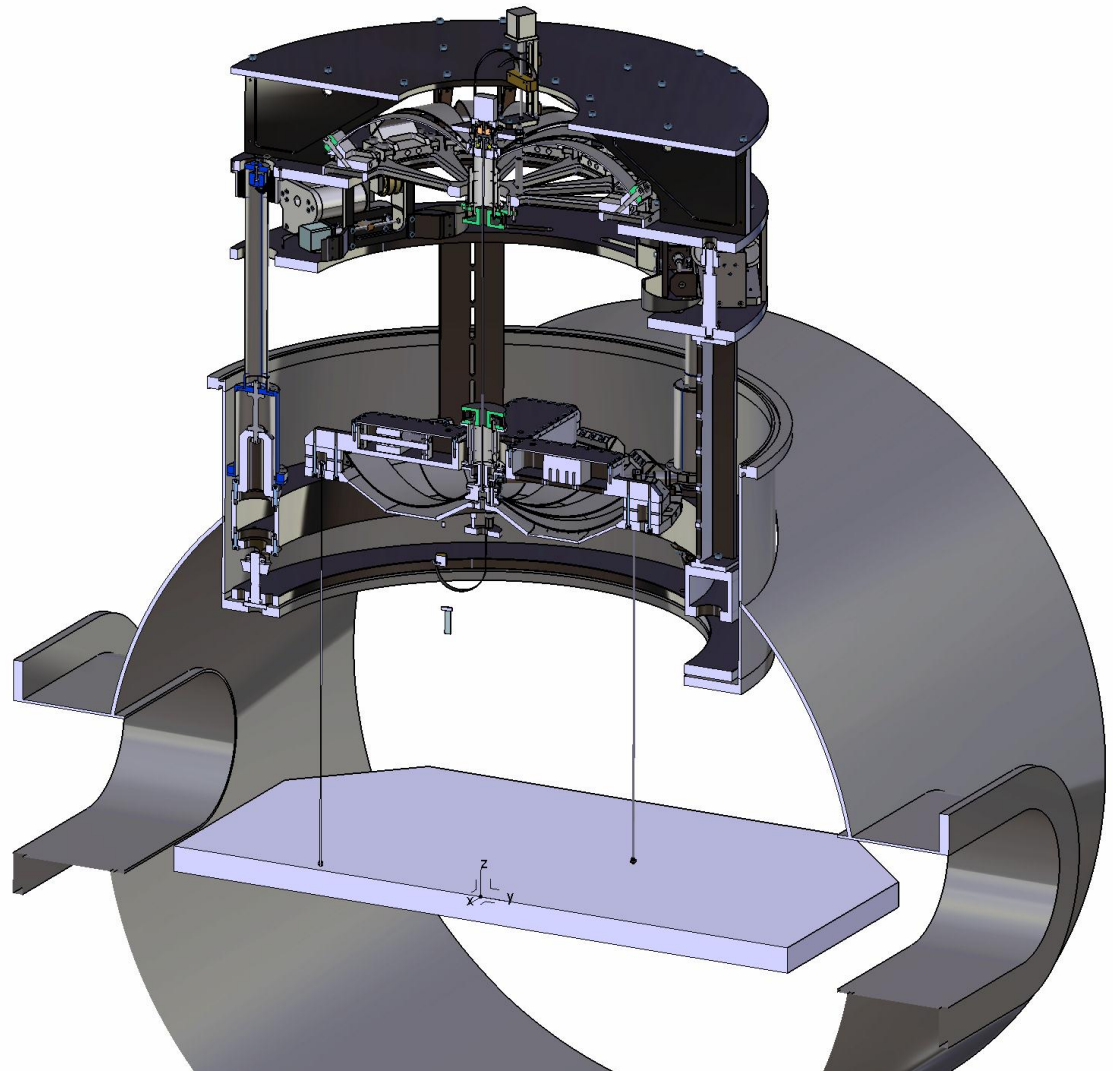
MINI-TOWER INTERFACE

- IP support structure
 - Tilt stability (< 0.1 mrad)
 - FEA vacuum forces
 - Agree on interface
- Clean-air flow system
 - Integration
- Vacuum issues
 - Materials
 - Procedures

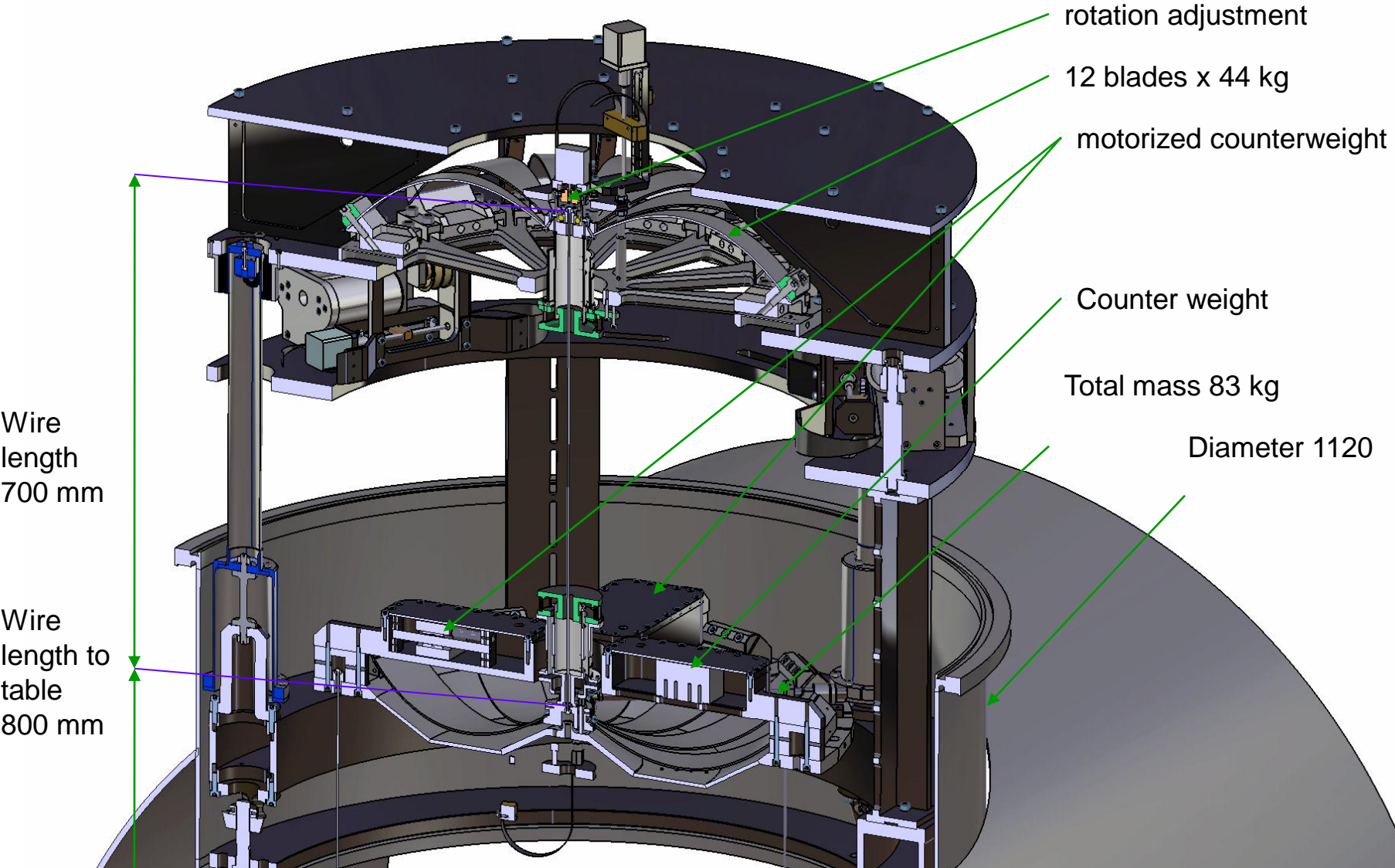


OVERVIEW

- **Horizontal isolation**
 - Inverted pendulum
 - Single wire suspension
 - Triple wire suspension
- **Vertical isolation**
 - Top GAS filter
 - Bottom GAS filter
- **Inertial damping**
 - From top GAS
- **Bench control**
 - From ground
 - Confirm performance



DIMENSIONS AND WEIGHTS



rotation adjustment

12 blades x 44 kg

motorized counterweight

Counter weight

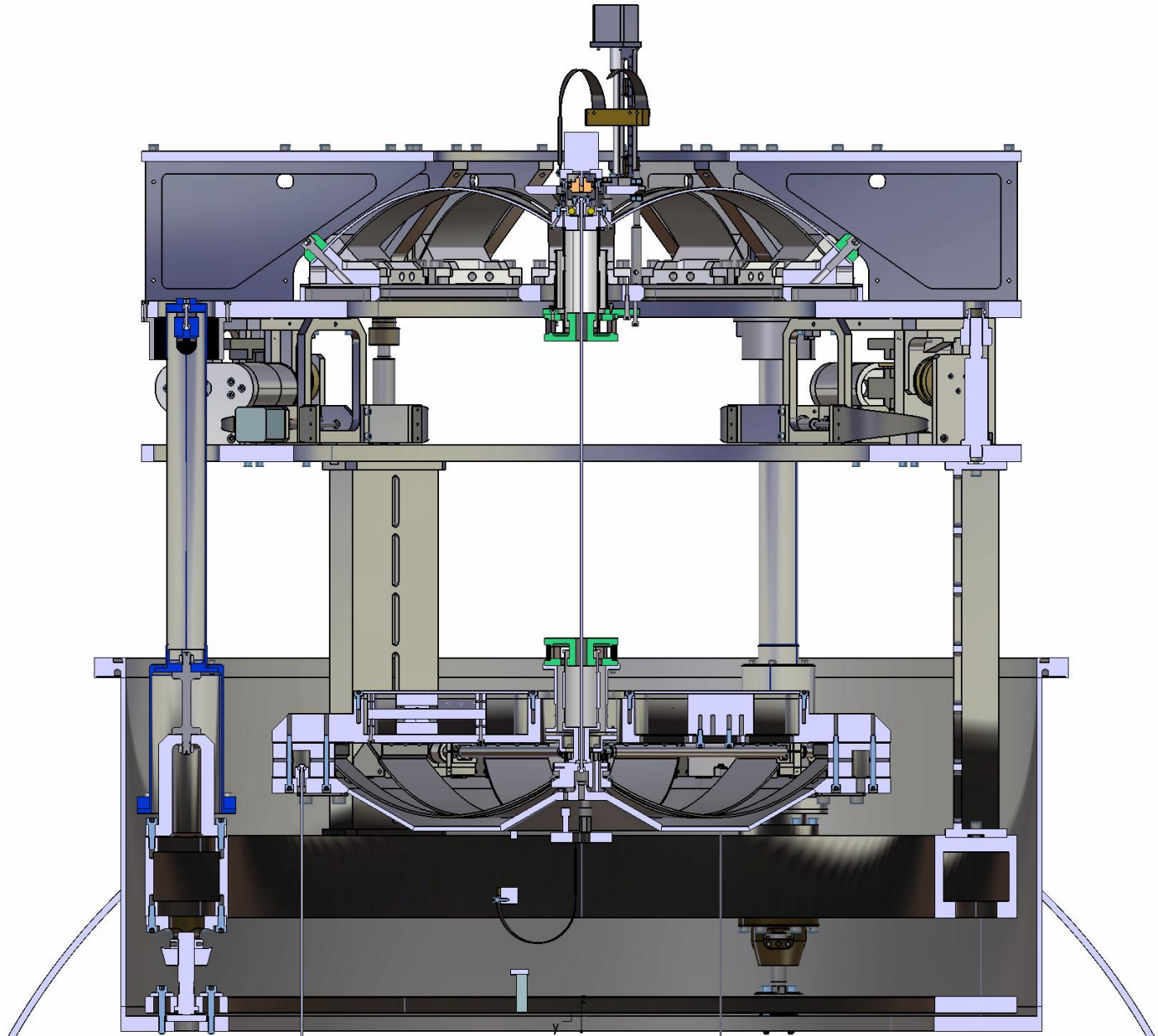
Total mass 83 kg

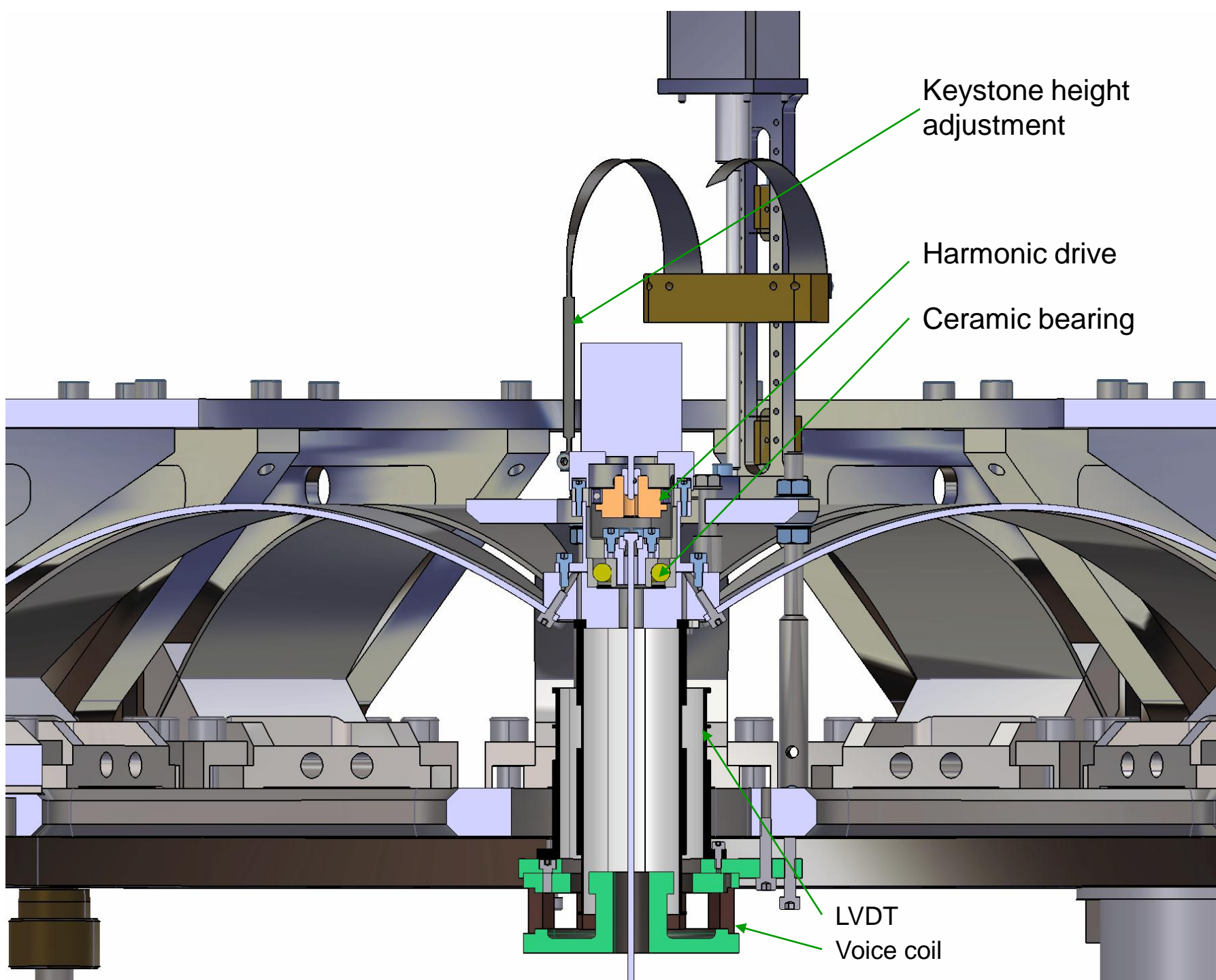
Diameter 1120

Wire length 700 mm

Wire length to table 800 mm

CROSS SECTION





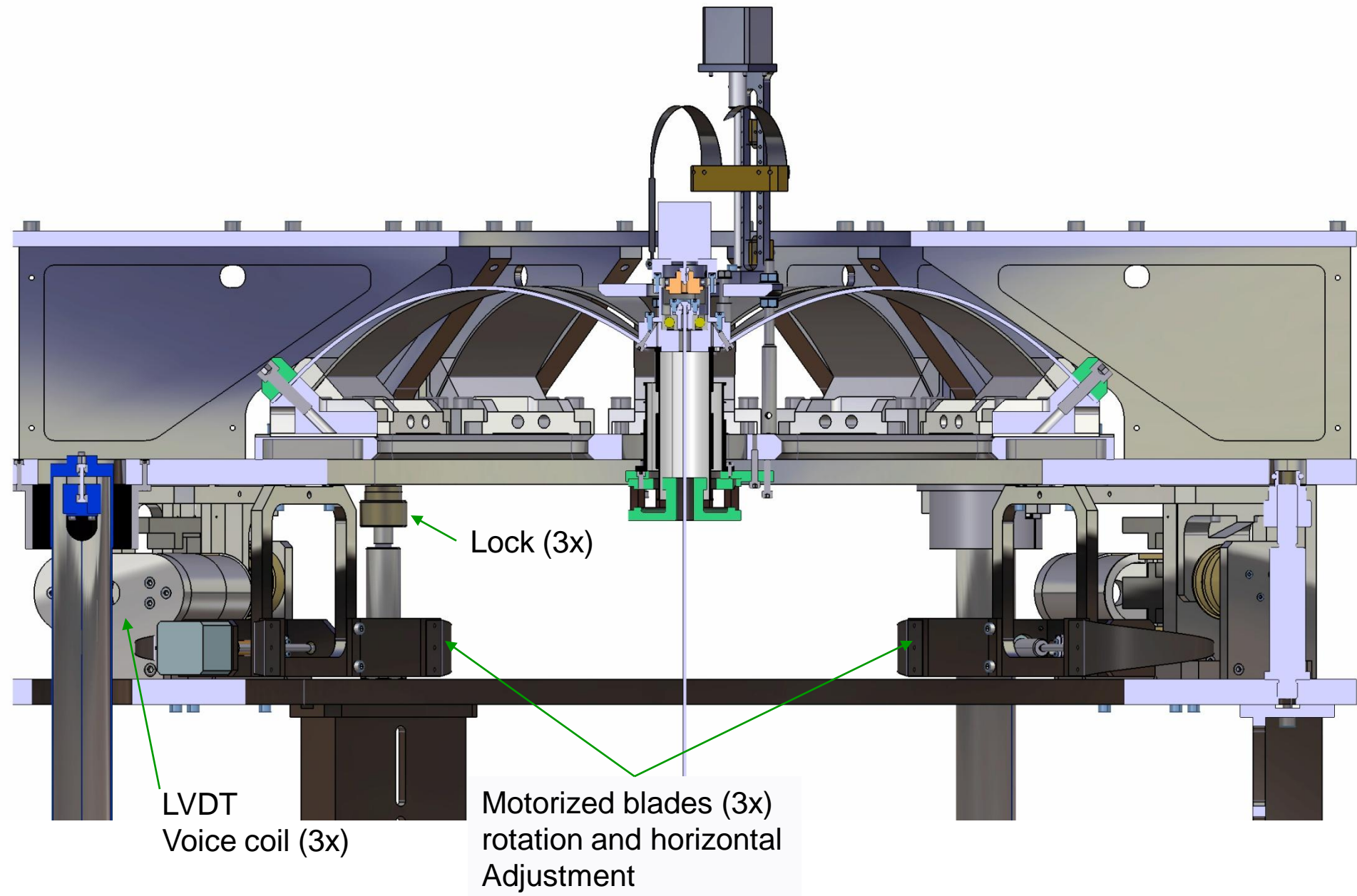
Keystone height adjustment

Harmonic drive

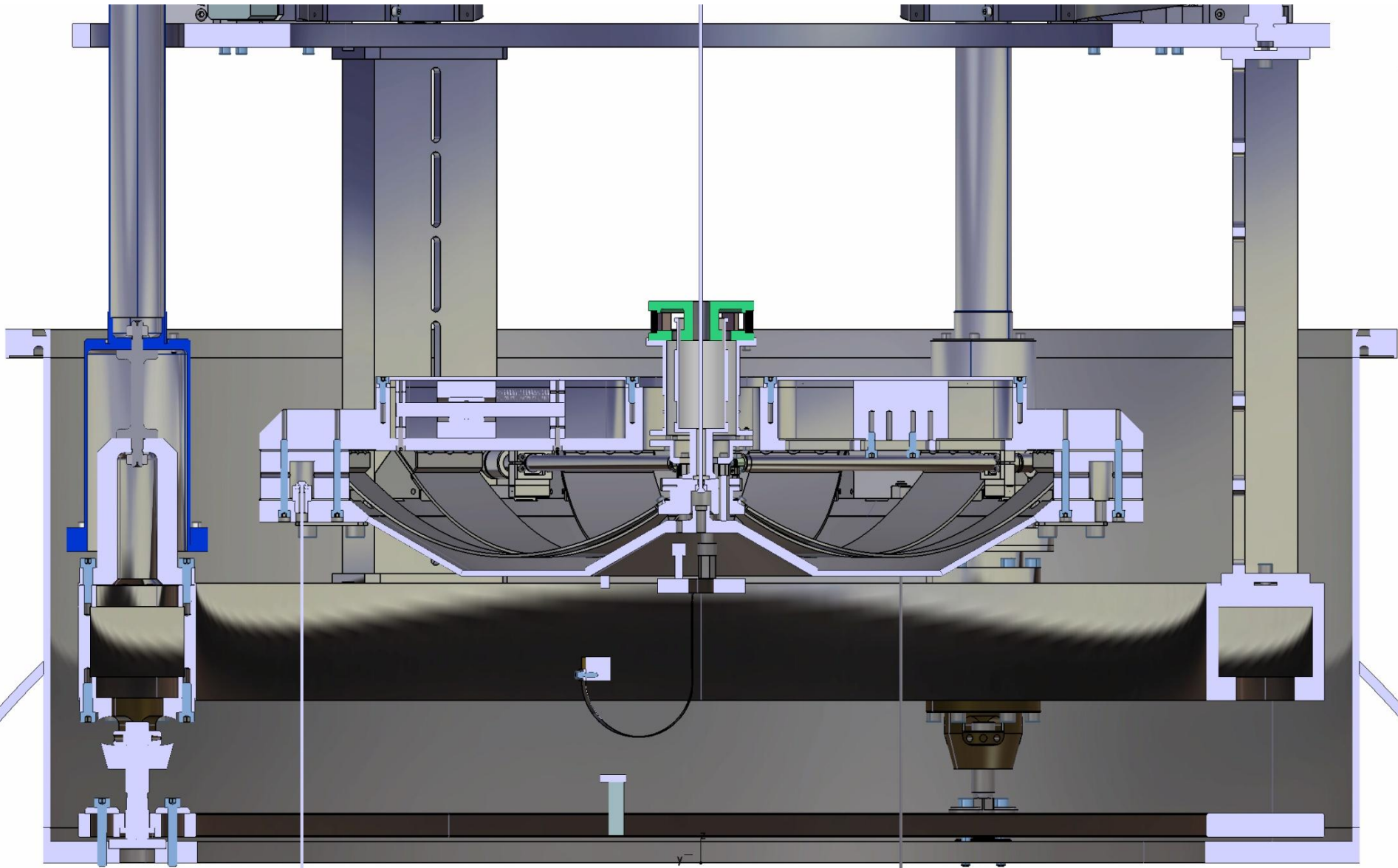
Ceramic bearing

LVDT
Voice coil

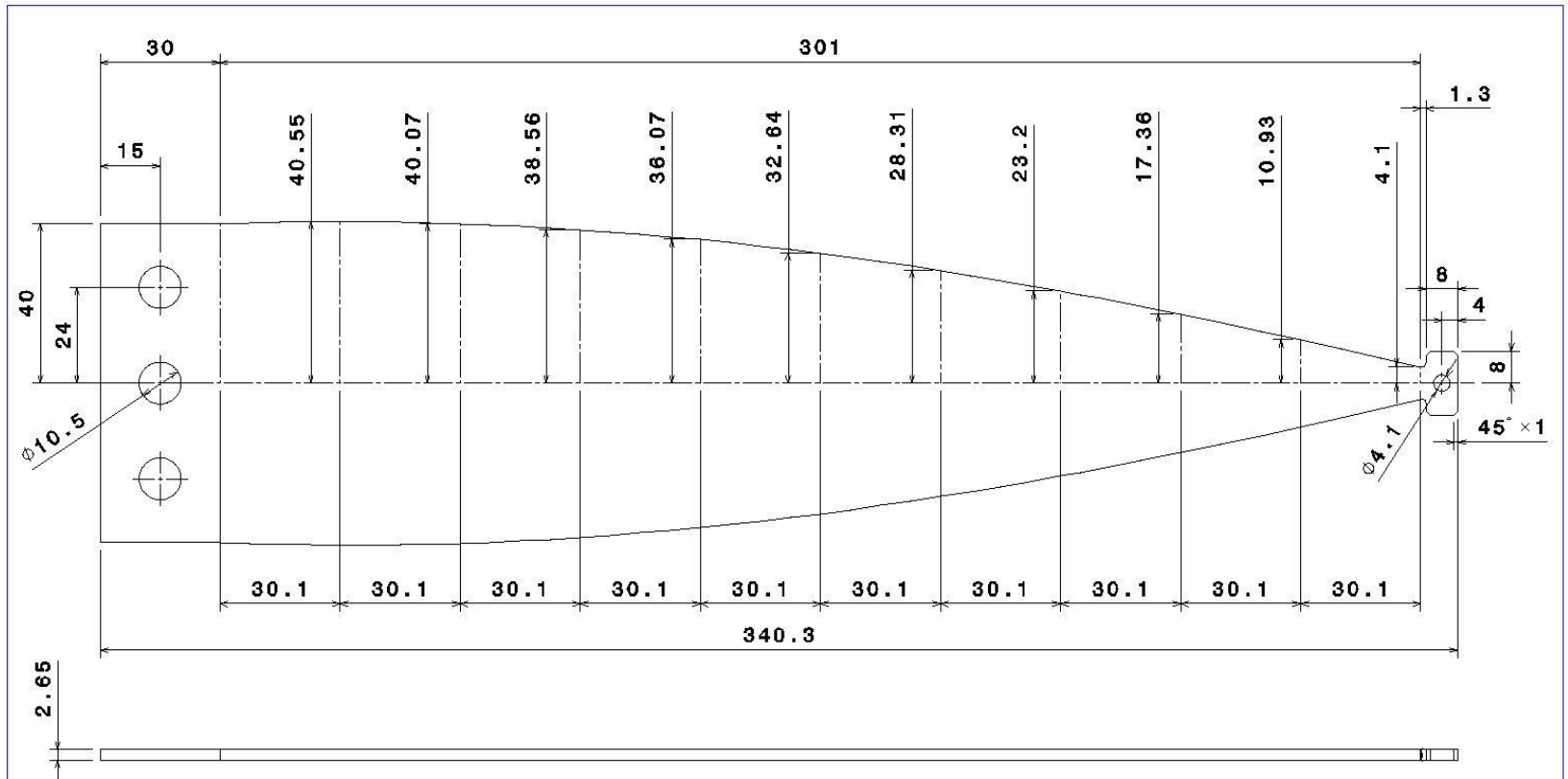
TOP STAGE




BOTTOM STAGE



GAS BLADE DESIGN (PRELIMINARY)



Scale: 1:1

07	01	Blade Cella+10%	Maragin steel	XX	XX
PART NO.	NUM-BER	TITLE	MATERIAL	SIZE/NOTE	I. D. NO. /NORM
Project: <input checked="" type="checkbox"/>		Date		Name	
Title: Cella blade +10%		Revision		Date	
Scaler: 1:1		Drawn: M Doets		A	
Date: 12-07-2011		Checked:		B	
		DIN in mm		C	
National institute for subatomic physics		DERN LABEL		D	
P.O. 41002, 1009 IB Amsterdam, The Netherlands		General tolerances unless otherwise stated according to ISO-2768-mk-E		Geometrical tolerances unless otherwise stated according to ISO-8015-E	
Size: A3		Roughness unless otherwise stated according to DIN 1302		Identification No.:	
Sheet No: X		Number of sheets: X			

This drawing may not be used for commercial purposes without written authorization.

PERFORMANCE STUDIES

Preliminary

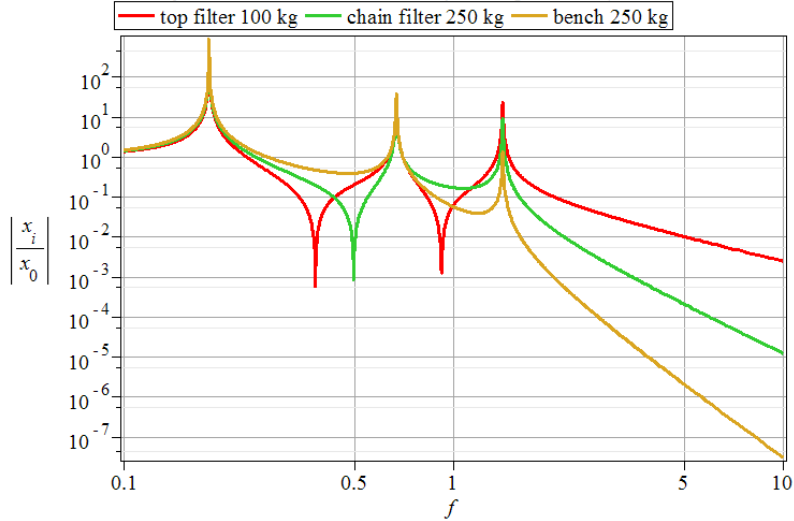
Specs of all models in this paper:

- IP-mode tuned at 200 mHz
- IP top plate including filter has mass 100 kg
- **3-body** system: 1=top filter, 2=chain filter, 3=bench (chain filter including marionette function)
- **4-body** system: 1=top filter, 2=chain filter, 3=marionette, 4= bench
- Total suspended mass $m_{\text{sus}} = m_2 + m_3 (+m_4) = 500 \text{ kg}$ (= top filter maximum load)
- Bench mass 250 kg unless otherwise specified
- Total wire length $L_{\text{tot}} = L_1 + L_2 (+ L_3) = 200 \text{ cm}$
- Wires infinitely flexible
- Only 3 (4) rigid body horizontal modes considered
- Transfer functions plotted with bandwidth 1 mHz for all modes.
- Created using Maple

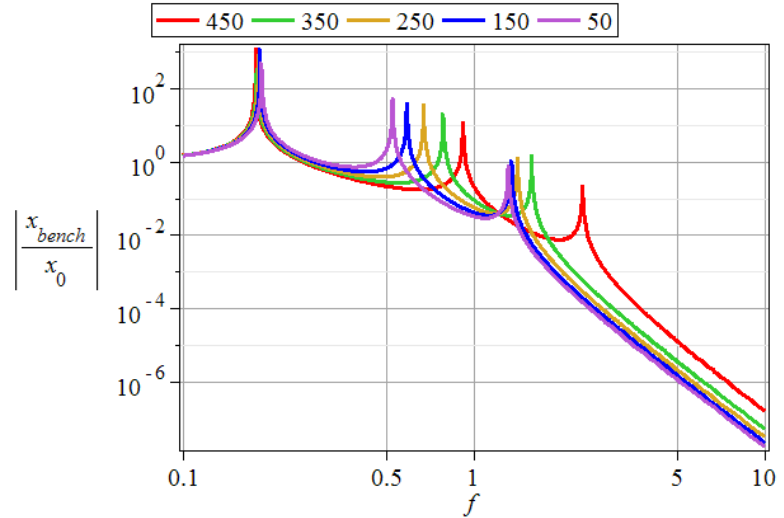
3 – BODY STUDIES

Preliminary

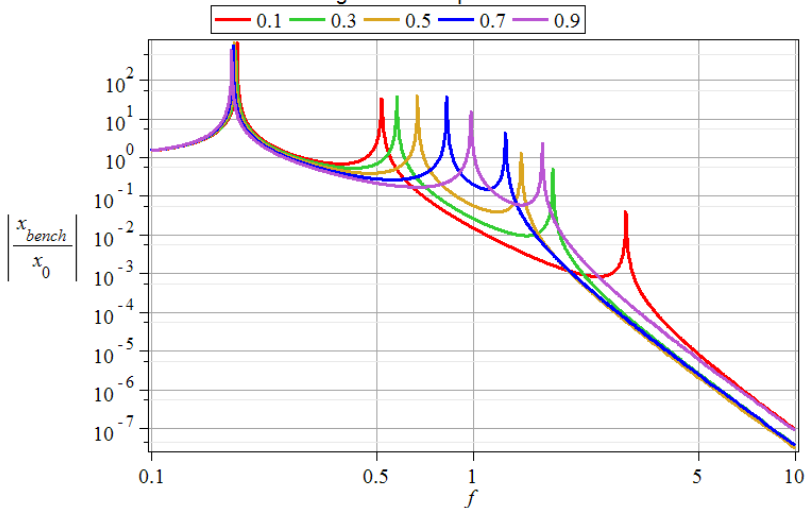
3 body Minitower model TFs for equal length wires (66 cm)



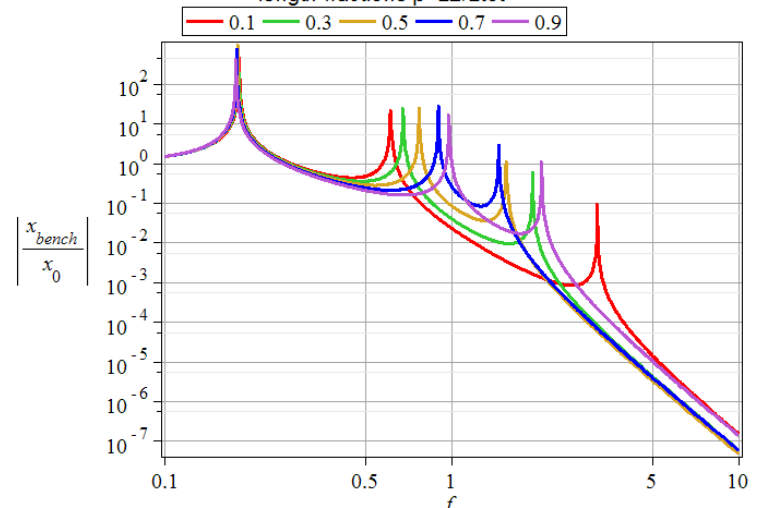
3 body minitower bench TF, equal wire lengths ($\beta=0.5$) and varying bench masses



3-body minitower bench TF, equal suspended masses (250 kg each), varying filter wire length fractions $\beta=L2/L_{tot}$



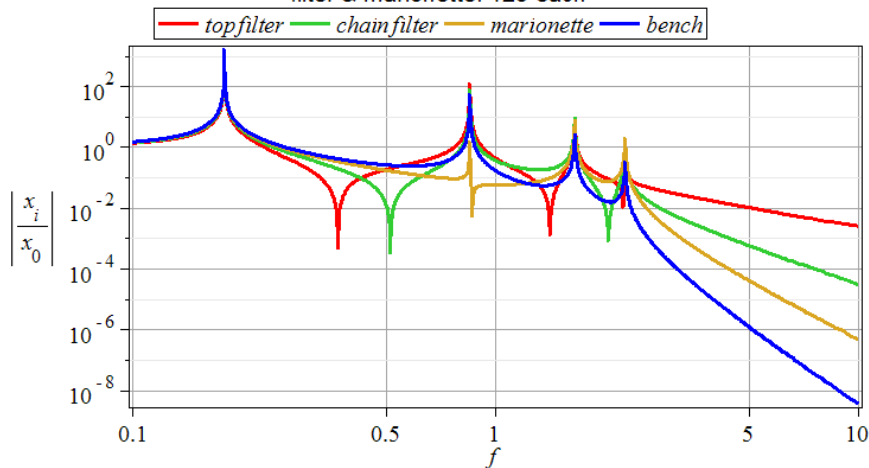
3-body minitower bench TF, bench mass 340 kg and varying filter wire length fractions $\beta=L2/L_{tot}$



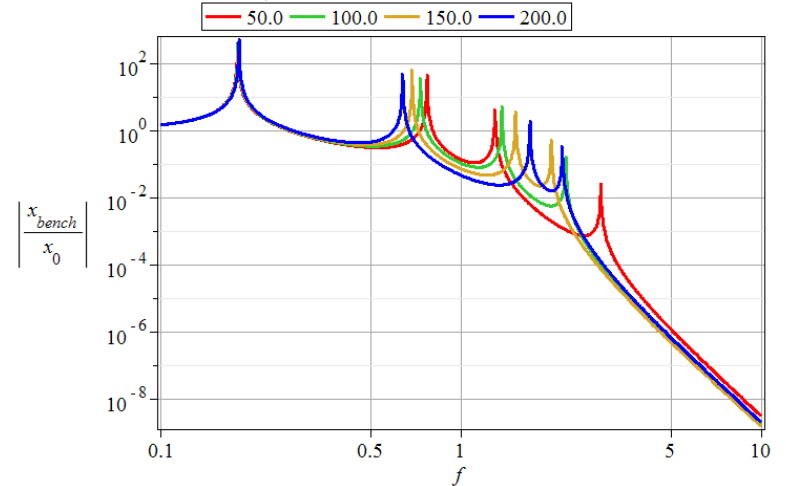
4 – BODY STUDIES

Preliminary

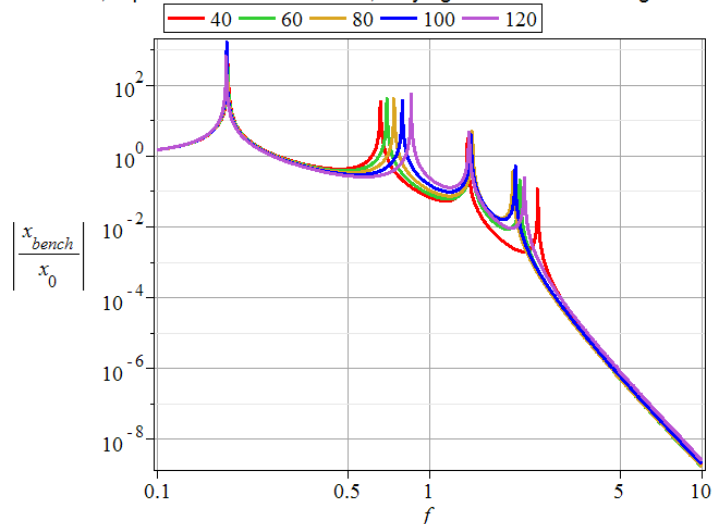
4body minitower TFs, all wires 66 cm, bench mass 250kg, IP-top filter 100, chain filter & marionette: 125 each



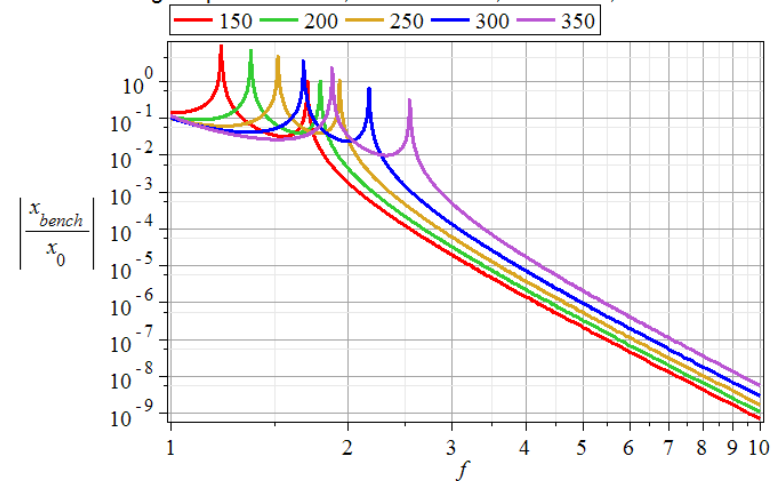
4body bench TFs, all wires 66 cm, bench 250 kg, top filter 100, total suspended 500, for various chain filter masses.



4 body bench TFs, mass 250 kg, IPtop 100, chain filter & mario 125 kg each, equal bench & mario wires, varying chain filter wire length



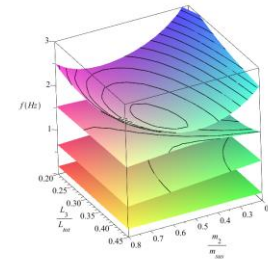
4 body minitower close to optimal configuration for several bench masses, Total 500 kg suspended mass, L2=L3=80 cm, L4=40 cm, m2/m3=0.55



PERFORMANCE STUDIES

Preliminary

4-body modal frequencies; fixed filter wire length $L_2=84\text{cm}$ ($\beta_2=0.42$), varying filter mass and mario wire length



Conclusion: optimal configurations (= lowest TF @ 10 Hz)

For ~ 350 kg bench:

3 body:

$L_2=140\text{ cm}$, $L_{\text{bench}}=60\text{ cm}$

$f_4=1.45\text{ Hz}$ (modal)

$\text{TF}_{\text{bench}} = 5\text{e-}8$ @ 10 Hz

4-body:

$m_2= 82\text{ kg}$, $m_3= 67\text{ kg}$,

$L_2=60\text{ cm}$, $L_3=70\text{ cm}$, $L_{\text{bench}}=50\text{ cm}$

$f_4=2.55\text{ Hz}$ (modal)

$\text{TF}_{\text{bench}} = 5\text{e-}9$ @ 10 Hz

For ~ 250 kg bench:

3 body:

$L_2=80\text{-}120\text{ cm}$, $L_{\text{bench}}=120\text{-}80\text{ cm}$

$f_4=1.3\text{-}1.5\text{ Hz}$ (modal)

$\text{TF}_{\text{bench}} = 3\text{e-}8$ @ 10 Hz

4-body:

$m_2= 137\text{ kg}$, $m_3= 113\text{ kg}$,

$L_2=70\text{ cm}$, $L_3=70\text{ cm}$, $L_{\text{bench}}=60\text{ cm}$

$f_4=2\text{ Hz}$ (modal)

$\text{TF}_{\text{bench}} = 1.5\text{e-}9$ @ 10 Hz

Displacement noise well below 10^{-12} m/rtHz at 10 Hz

LOGISTICS

- **Issues**
 - Design in progress
 - Mechanics
 - Simulations
 - Accelerometers, LVDTs, actuators, stepping motors
 - Experience with EIB-SAS
 - Interface with mini-tower
 - IP support ring (specify tilt requirements)
 - Controls from ground: performance
- **Prepare prototype**
 - Construction H2 2011
 - Test H1 2012
 - Vacuum vessel needed
 - Specify tests
- **Cost estimate**

QUESTIONS

- Beam spot motion
 - Spot movement on QPD
 - Acceptable?
 - RMS movement
 - Low frequency cut-off control signals from QPD?
- M. Mantovani - DIM - 28 Jul 2011 - VIR-0444A-11
- Angular requirement
 - Sensitivity of telescope?

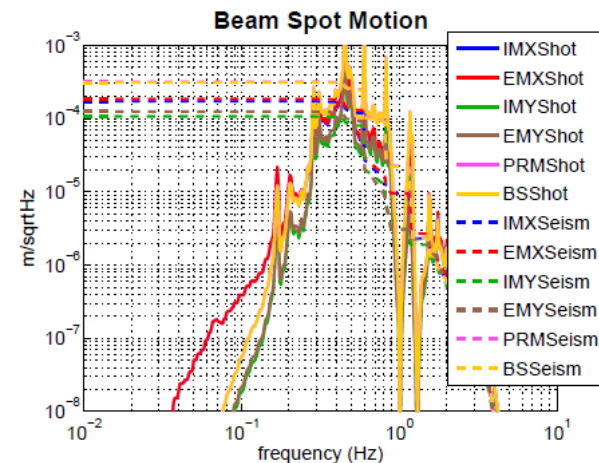


Figure 10: Beam spot motion on the optics.

Automatic Alignment Sensing and Control scheme for Advanced Virgo MSRC configuration

VIR-0201A-11

M. Mantovani

Issue: 1

Date: April 18, 2011

	Requirement (330 μ m beam)
δh	1.1e-11 m/sqrt(Hz)
$\delta \theta$	1.5e-14 rad/sqrt(Hz)
h_{RMS}	6.4e-7 m
θ_{RMS}	9e-10 rad
	Requirement (1650 μ m beam)
δh	5.4e-11 m/sqrt(Hz)
$\delta \theta$	7.6e-14 rad/sqrt(Hz)
h_{RMS}	3.2e-6 m
θ_{RMS}	4.4e-9 rad